UNIVERSITI TEKNOLOGI MARA

ECOLOGICAL STUDIES OF APHID (*Aphis gossypii* Glover), VECTOR OF VIRUS DISEASE OF CHILLI (*Capsicum annuum* L.) AND ITS PREDATORS

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to other any academic institutions or non-academic institutions for any other degree of qualifications.

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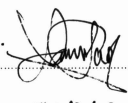
Signature of Candidate:		
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ABSTRACT

Studies were conducted to determine the seasonal trends of the cotton aphid *Aphis gossypii* Glover (Homoptera: Aphididae), its natural enemies (Coccinellidae, Chrysopidae and Araneae) and virus disease incidences on chilli variety MC4 in seven cropping periods. Sampling of alate *A. gossypii* was done using yellow pan trap while the apterous, natural enemies and virus disease incidence were counted *in situ*. The spatial distribution of arthropods within each cropping period was analyzed using variance-to-mean ratio, Morisita's Index and Lloyd Index of Patchiness model. The spatial distribution of arthropods between cropping periods was analyzed using Taylor's Power Law and Patchiness Regression model while virus incidences were analyzed using logistic model. Results of the study showed that apterous aphids were found in abundance at the bottom stratum. The populations of apterous aphids on chilli were found to be low in the first 4 cropping periods but high in the fifth, sixth and seventh cropping period. Alate aphid population were found significantly higher in the early morning, 0500 and 1000 hr and significantly lower in the evening, 1400 and 1600 hr. The population of natural enemies, coccinellidae, chrysopidae and araneae were found low throughout the seven cropping period where the coccinellidae, chrysopidae and araneae preferred the upper, bottom and middle stratum, respectively. Generally, the cumulative data showed a sigmoidal trends. The vertical distribution of apterous *A. gossypii* and its natural enemies seems to be influenced with climatic condition and phenology of chilli plant along the vertical gradient of chilli plants. Analysis of virus disease incidence showed a slow development of virus disease during the early and late growth period while rapid development was observed in the middle growth period of each cropping. The fifth cropping period demonstrated the most rapid development of virus infection compared to other cropping periods. The Virus Apparent Infection Rate (VAIR) analysis revealed that average increasing rate of virus disease in all cropping periods was from 0.077 to 0.32 unit. The analysis also revealed that, the disease took 46.9 to 67.0 days to spread 50% in all cropping periods and 50.2 to 70.1 days to infect 90% of the plot. The Area Under Disease Progress Curve (AUDPC) analysis showed that the chilli plant was highly infected with viruses in the flowering stage followed by fruiting stage. The within field spatial distribution of virus count data were illustrated by the 'red-blue' plots which were analyzed using SADiE (Spatial Analysis by Distance Indices), showed a ephemeral spatial pattern of virus incidences in each sampling date of every cropping periods. Results of the study

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CHAPTER ONE

INTRODUCTION

Chilli belongs to the genus *Capsicum* which contains about 20-35 species, all of which are New World in origin. In Malaysia, only two domesticated species of *Capsicum* are cultivated viz., *C. annuum* and *C. frutescens*. Between the two species, *C. annuum*, which include red chilli (*C. annuum* cv. group Acuminatum) and bell pepper (*C. annuum* cv. group Grossum) are grown commercially. The species *C. frutescens* which includes bird chilli is grown sporadically in small plots by farmers (Idris et al., 2001b). At present, the varieties of *C. annuum* cv. group Acuminatum that are popularly planted by farmers are Langkap, Kulai, MC11, Tanjung Minyak and Cili Puteh. Varieties like Cili Bangi CB1, CB2, CB3, CB4 (Idris et al., 2001a), CB5 and CB6 (Gulia Hidayani, 2001) were developed by the Universiti Kebangsaan Malaysia are gaining acceptance by farmers.

Chilli is a high value crop with a growing domestic demand as well as having exported potential to neighbouring countries. The importance of chilli is further enhanced by the employment opportunity provided by chilli-related industries. Many growers are reluctant to venture into cultivation of chilli because of the high risks due to pests and diseases. As a result, heavy pesticide usages have been practiced to ensure a successful crop. This leads to high pesticides residue on the chilli fruits, which is detrimental to the consumer's health and well-being (Mah et al., 2001).
With the cultivation of chilli as a monocrop and the practice of calendar pesticide spraying by farmers, the problem of pests and diseases have been escalated (Mohamad Roff and Ong, 1992).

In the cultivation of chilli, farmers are facing several constraints, which include diseases caused by viruses (Ho et al., 1990). Virus diseases are one of the major limiting factors in the production of chilli mainly because some of them are widespread in the country. Direct chemical control is yet not available and at time virus symptoms are being confused with symptoms driven by mite and thrips infestation (Mohamad Roff and Ong, 1992).